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Comparative Analysis of Stomatal Type *Swietenia macrophylla* King and *Polyalthia longifolia* Bent and Hook. var. Pendula in Makassar, South Sulawesi, Indonesia

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Abstract

The purpose of this research was to know comparative analysis of leaf stomatal trees *Swietenia macrophylla* King and *Polyalthia longifolia* Bent & Hook. Var. Pendulain Makassar City. This research has been conducted in A.P. Pettarani Street and Industrial Area Makassar. This research used modification method acetonethen performed a descriptive analysis. The results showed that stomatal type of *Swietenia macrophylla* and *Polyalthia longifolia* is parasitic and phanerophor. The highest density of leaf stomatal on *Swietenia macrophylla* King is877 stomata mm^{-2} in Industrial Area Makassar and the lowest density of stomatal on the leaf *Polyalthia longifolia* Bent & Hook. var. Pendulais 411 stomata $mm^{-2,}$ in A.P. Pettarani Street.

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Keywords

Comparative, Stomatal Trees, Makassar City.

Introduction

Green Open Space is a form of land use in urban areas that are intended for greening the city (Abril, 2009). Increased concentrations of CO_2 in atmosphere will cause a rise in temperature of the earth, so occurred Greenhouse Effect. The growth response due to CO_2 is too high above the threshold, can lead to changes in morphology, anatomy and biochemistry of plants (Singsaas *et al*., 2003), can also cause leaf stomata partially closed, thus reducing transpiration (Gohil *et al*., 2010). Vegetation must possess certain characteristics that can help overcome the problems associated with the environment.Urban vegetation serves to give an aesthetics, unifying space, minimize air pollution, produce oxygenand micro-climate amelioration (Grey and Deneke, 1978; Lovelli *et al*., 2010; Zhao *et al*., 2009). Makassar is city center of various activitiessuch as the economy and education, so that the population is getting ever-growing.

The number of people in Makassar resulted in community activities is also increasing, it can be seen from density of vehicles on the roads.To balance CO_2 emissionsneed to be coupled with greening trees in Makassar by planting various species of trees in accordance with the allotment of land. Based on the description above, so that the research of comparative analysis of stomatal type *Swietenia macrophylla* King and Bent & Hook. var. Pendula in Makassar was conducted.

Materials and Methods

Plant materials

Leaf of trees greening namely *Swietenia macrophylla* King and *Polyalthia longifolia* Bent & Hook. var. Pendula.

Stomatal analysis

Leafof trees greening used in this research were selected characteristics from trees that look healthy and disease. Analysis of stomatal using a modified method of acetone (Tambaru *et al*., 2014), each leaf smeared with acetone for ± 2 minutes, samples were placed on a glass object and observed under a binocular microscope with micrometer scale, then image taken using microscope Bino& Photo.Observations stomatal characteristics used reference Nugroho *et al*., 2006; Sunarti *et al*., 2008; Pandey and Chandha, 1996; Agustini, 1999 and Kurnia, 2005 *cit.* Hidayat, 2009. Calculations for stomatal index (IS) based formula (Wilmer (1983) *cit.* Damayanti, 2007) as follows:

$$IS = \frac{S/L}{(S+E)/L} \times 100\%$$

whereby:
S = number of stomata
E = number of epidermal cells
L = unit leaf area

Stomatal analysis also do descriptively. This resarch was also measured of environmental factors as supporting data.

Results and Discussion

The results of analysis stomatal characteristics which grows in A.P. Pettarani Street (busiest streets and polluting vehicles) and Industrial Area Makassar (polluted factory) is shown in table 1.

Type stomatal of *Swietenia macrophylla* and *Polyalthia longifolia* are *parasitic*, while both types of stomata in this research were found in *Dicotyledoneae.* Leaf stomatal in this class, the structure is spread on leaf epidermis tissue andkidney-shaped cells of stomata closing.Type of deployment stomatal *Swietenia macrophylla* and *Polyalthia longifolia* on the surface of adaxialwhere the number of stomata less than the abaxial surface.According to Pandey and Chandha (1996), type of stomata which are spread on both surfaces of leaves called potato type (Table 1). The number of stomata on *adaxial* surface less, it is a mechanism of adaptation trees to the terrestrial environment (Campbell *et al*., 2003), thus reducing transpiration (Larcher, 1995; Taiz and Zeiger, 2002).

Stomatal density of leaf *Swietenia macrophylla* highs above 500 stomata mm^{-2}. Density of leaf stomatal *Polyalthia longifolia* including medium criteria with the number of leaf stomatal300-500 stomata mm^{-2}. According Agustini (1999) and Kurnia (2005) *cit* Hidayat (2009), size of stomata length: long enough (<20 m), length (20-25 m) and very long (> 25 m). Stomatal density: low (<300 stomata $mm^{-2)}$, medium (300-500 stomata $mm^{-2)}$, and high (> 500 stomata $mm^{-2)}$. The highest number of epidermal cells *abaxial* tree species *Swietenia macrophylla* as much as 3396 mm^{-2} epidermal cells is on site Industrial Area Makassar, the lowest on type *Polyalthia longifolia* is 1681 mm^{-2} epidermal cells on site Industrial Area Makassar (Table 1). The influence of environmental factors and type of plants can affect number of epidermis cells.Types of trees that grow in polluted environments has a number of epidermal cells leaves more than a less polluted, as well as the number of stomata less.

The measurements of environmental factors in A.P.Pettarani Street that is dust content 79.57-116.322 $\mu gN/m^{3,}$ wind velocity 0.30-1.51 m/sec. Temperatures 30.80-38.70^{0}C, and humidity 30.67- 56.33RH %. Industrial Area Makassar were dust content 36.793 - 140.535 $\mu gN /m^{3,}$ wind velocity 0.56-2.25 m/sec. Temperatures 33.9 - 43.00^{0}C and humidity 34.33-51.00RH%. The number of leaf stomatal can be affected by location of a place to growand type of plant. It is supported by the results of this research, thatpolluted environmentlike on A.P. Pettarani Street and Industrial Area Makassar, density of leaf stomatal small amounts.

The reduced number of stomata on the leaf surface, can be caused by dust adsorbed on the surface of leaf, thus covering the stomatal. According to Gardner *et al.*, (1985); Fitter and Hay (1981), on the leaf surface there are a number of stomata that serves as the CO_2diffusion when stomatal open. Absorption of CO_2into leaf tissue is physiologically related to the number of stomatal per unit leaf area. Damage leaf stomatal can be caused by dust particles adsorbed on the surface of leafthat entering through a gap stomata.

Table.1 Stomatal characteristics based longitudinal cross-section leaf greening trees in A.P. Pettarani Street and industrial area Makassar

Characteristics	*Swietenia macrophylla*		*Polyalthia longifolia*	
	A	B	A	B
Location of stomatal	*adaxial* and *abaxial*	*adaxial* and *abaxial*	*Adaxial* and *abaxial*	*Adaxial* and *abaxial*
Type stomatal	*parasitic*	*parasitic*	*parasitic*	*parasitic*
Long stomatal	16.8 to 21.6 µm	19.2 µm	24 to 26.4 µm	19.2 to 21.6 µm
Width of stomatal	14.4 to 19.2 µm	16.8 to 19.2 µm	19.2 to 21.6 µm	14.4 to 16.8 µm
Stomatal Index	19.16 to 22.57%	19.32 to 21.36%	14.49 to 16.94%	19.69 to 23.04%
Cell shape of closing stomatal	kidney-shaped	kidney-shaped	kidney-shaped	kidney-shaped
The layout of the cell cover	Panerofor	Panerofor	Panerofor	Panerofor
StomatalOpening	7.2 to 9.6 µm	4.8 to 7.2 µm	4.8 to 7.2 µm	4.8 to 7.2 µm
The spread of stomatal	Irregular	Irregular	Irregular	Irregular
Deployment Type of Stomatal	Type *potato*	Type *potato*	Type *potato*	Type *potato*

Description: (A) Location in A.P PettaraniStreet and (B) Location in Industrial Area Makassar.

Table.2 Comparison of leaf stomatal on location A.P. Pettarani Street and Makassar Industrial Estate

Characteristics	***Swietenia macrophylla***		***Polyalthia longifolia***	
	A	B	A	B
Stomal Density *Abaxial* (mm^{-2})	743	877	411	443
Number of Cells A*baxial* Epidermis (mm^{2})	2876	3396	2183	1681
Abaxial Stomatal Index (%)	20.480	20.497	15.880	20.943

Description: (A) Location A.P. Pettarani Street and (B) Location Industrial Area Makassar.

Fig.1 *Swietenia macrophylla* (A) and *Polyalthia longifolia* (B); Tree (1), Stomatal Adaxial (2), and Stomata Abaxial (3). Stomata 400x magnification

According Rantung (2006) dust particles entering into stomatal, can accumulate around the leaf tissue, causing damage stomata, which in turn can inhibit absorption of CO_2, growth and development of trees.

Conclusion

The results showed that stomatal type of *Swietenia macrophylla* and *Polyalthia longifolia* is parasitic and phanerophor.The highest density of leaf stomatal on *Swietenia macrophylla* is 877 stomata mm $^{-2}$ in Industrial Area Makassar and the lowest density of stomatalon the leaf *Polyalthia longifolia* Bent & Hook. var. Pendulais 411 stomata mm$^{-2,}$ in A.P. Pettarani Street.

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